

REMARKS

In the Office Action, claims 1-23 were rejected. By the present Response, claims 1, 20 and 23 are amended. Upon entry of the amendments, claims 1-23 will remain pending in the present patent application. Reconsideration and allowance of all pending claims are requested.

In the Claims

By the present Response, the claims are correctly reproduced as filed in the response to the Final Office Action issued prior to the Appeal. Applicants noted that while listing the claim in the Appeal Brief, the word "and" in claim 1 was erroneously replaced by "or". Claim 1 as presented in the present Response reflects the correct wording prior to the amendment made herein. Applicants sincerely apologize for the error in the earlier presentation (in the Appeal Brief).

Rejections Under 35 U.S.C. § 102

In the Office Action, claims 1-12 and 14-23 were rejected under 35 U.S.C. § 102(b) as being anticipated by Byrne et al., U.S. Patent No. 6,211,676 (hereinafter "Byrne"). A *prima facie* case of anticipation under 35 U.S.C. § 102 requires a showing that each limitation of a claim is found in a single reference, practice or device. *In re Donohue*, 226 U.S.P.Q. 619, 621 (Fed. Cir. 1985). Applicants respectfully traverse this rejection and assert that the present invention, as recited in independent claim 17 and amended independent claims 1, 20 and 23 is patentable over the Byrne reference.

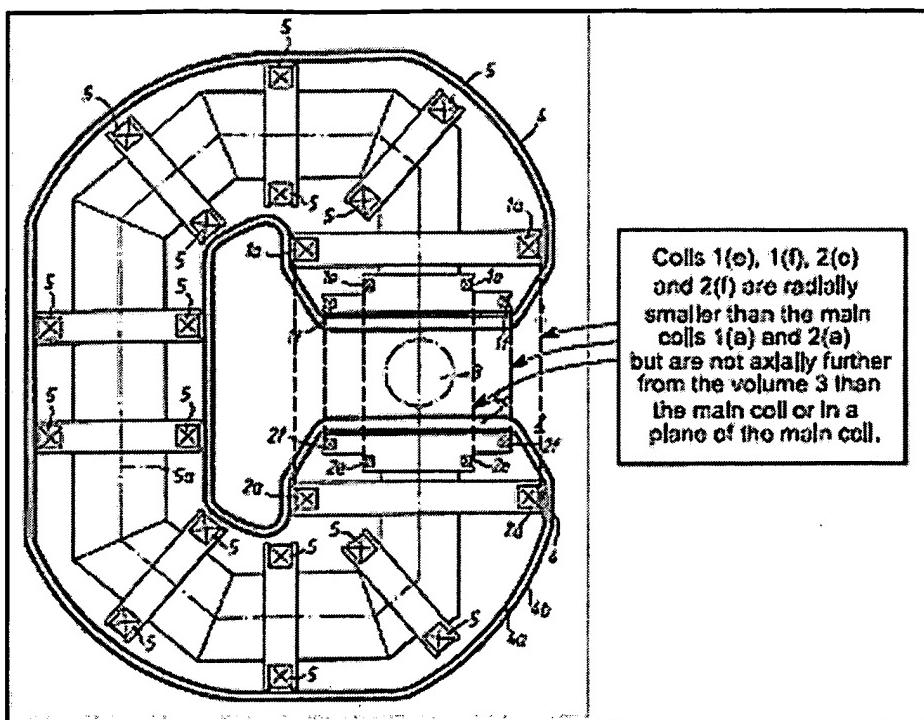
Independent claims 1, 20 and 23 and claims depending therefrom.

Independent claims 1, 20 and 23 are amended to more clearly point out certain of the claimed subject matter. Specifically, each independent claim now recites, in generally similar language, *shaping coils radially smaller than the main coil and positioned axially further from the imaging volume than the main coil or in a plane of the main coil to shape the magnetic field in the imaging volume*. This language is believed to be more

clear in that it specifies that the shaping coils are “smaller” than the main coil in the radial direction.

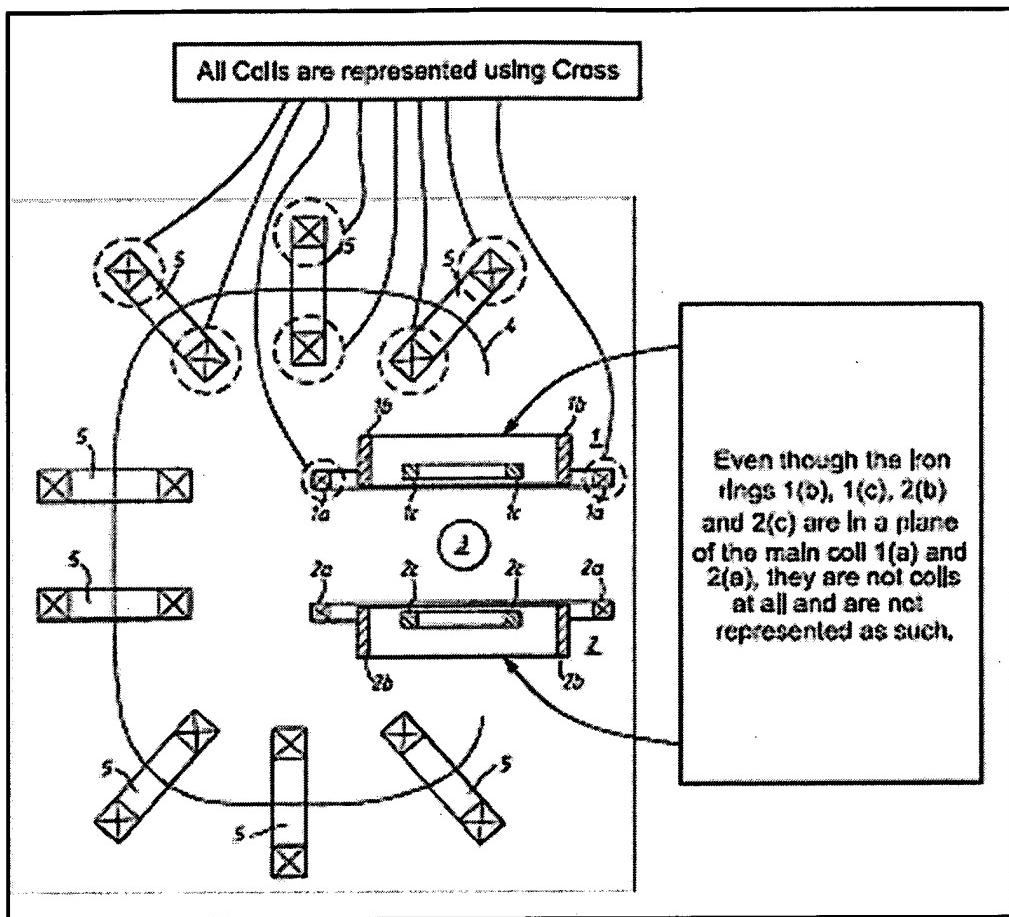
Applicants respectfully submit that there are two possibilities recited in claims 1, 20 and 23 for the positioning of the shaping coils with respect to the main coil. The first possibility requires positioning the shaping coils axially further from the imaging volume than the main coil (*see, Fig. 1*). The second possibility requires positioning the shaping coils in a plane of the main coil (*see again, Fig. 1*).

The Examiner argued that Byrne discloses the claimed arrangement of the shaping coils with respect to the main coil, and referred to Fig. 1 and Fig. 2 and further to column 3, lines 7-46. The Byrne reference discloses concentric coil components 1(e), 1(f), 2(e) and 2(f) or iron rings 1(b), 1(c), 2(b) and 2(c), *clearly in the alternative*, to cancel higher order terms in the magnetic field to achieve a very high degree of magnetic flux homogeneity in the imaging volume. (*See, Byrne, column 3, lines 14-17*). However, Applicants respectfully submit that, in none of the embodiments of Byrne are the concentric coil components shown to be (1) *axially further from the imaging volume than the main coil* or (2) *in a plane of the main coil*. The Applicants have reproduced Fig. 1 of Byrne herein below to assert the above stated observation.



In particular, as is clear from the first figure of Byrne reproduced above, when Byrne uses actual coils 1(e), 1(f), 2(e) and 2(f), these are not more removed from the imaging volume, but are actually closer to the volume. Similarly, it is clear from the figure that these coils are not in the plane of either main coil 1(a) or 2(a).

Moreover, in none of the embodiments of Byrne are the iron rings shown to be axially further from the imaging volume than the main coil. Additionally, the iron rings disclosed in Byrne are not coils and are not represented as such. The Applicants have reproduced Fig. 2 of Byrne below to demonstrate this deficiency in Byrne. That is, when Byrne intends to use “coils” these are clearly distinguished by crosses through the structures in the figures. The “iron rings” of Fig. 2 of the reference are clearly *not* “coils” as claimed. Clearly then, the iron rings of Byrne are not same as the shaping coils described in the present application.



Further, Applicants respectfully submit that the iron rings 130 and 135 disclosed in the present application are provided between the main coils 110, 115 and corresponding bucking coils 120, 125 in order to magnetically isolate (i.e., "shield") the main coils 110, 115 from the corresponding bucking coils 120, 125, to provide additional structural support for the MRI device 100, and to control the magnetic forces of main coils 110, 115 and bucking coils 120, 125. (See, Application, page 6, paragraph 0022). Thus, the main purpose of the iron rings in the present application is to balance the large attraction force between the main coils across the magnet gap with an opposite magnetic force towards the iron rings so that the net force between the main coils approaches zero or is repulsive. Applicants respectfully submit that the use of the iron rings to oppose the attraction force between the main coils creates a strong effect on the magnetic field that is

being compensated by the shaping coils in the present application. One reason for transferring the coil magnetic force to the iron rings is to enable a support structure for this force away from the magnet gap, as there is no room for any structural member inside the magnet gap. Thus, Applicants respectfully assert that the shaping coils in the present application are used to overcome the effect of iron rings on the magnetic field and are not used as an *alternative* to the iron rings of Byrne.

At least because Byrne do not teach, disclose or suggest shaping coils radially smaller than the main coil to shape the magnetic field in the imaging volume, and that are positioned (1) axially further from the imaging volume than the main coil or (2) in a plane of the main coil as claimed, the reference cannot support a *prima facie* case of anticipation of claims 1, 20 and 23.

Claims 2-12, 14-16, 21-22 depend directly or indirectly from claims 1 and 20. Accordingly, the Applicants submit that claims 2-12, 14-16, 21-22 are allowable by virtue of their dependency from an allowable base claim. Applicants also submit that the dependent claims are further allowable by virtue of the subject matter they separately recite. Thus, it is respectfully requested that the rejection of claims 1-12, 14-16 and 20-23 under 35 U.S.C. §102(b) be withdrawn.

Independent claim 17 and claims depending therefrom.

Independent claim 17 recites *at least one bucking coil disposed axially outside said at least one main coil with respect to said volume and configured to shield said at least one main coil, a plurality of shaping coils to shape said magnetic field in said volume, and a plurality of ferromagnetic rings for shielding interactions between coils of opposite polarity.* Independent claim 17 further recites *at least one of said plurality of ferromagnetic rings being positioned between said at least one main coil and said at least one bucking coil.*

Byrne fails to teach, disclose or suggest a bucking coil, a shaping coil *and a* plurality of ferromagnetic rings as recited above. The Examiner argued that Byrne discloses the claimed components as follows:

- (A) a plurality of pieces of magnetic shimming material supported on a pair of non-magnetic plates associated respectively with the field coils 1(a) and 2(a) in Byrne serves as bucking coils,
- (B) concentric coil components 1(e), 1(f), 2(e) and 2(f) or iron rings 1(b), 1(c), 2(b) and 2(c) or combinations of both in Byrne is equivalent to the shaping coils, and
- (C) iron rings 1(b), 1(c), 2(b) and 2(c) in Byrne is equivalent to a plurality of ferromagnetic rings for shielding interactions between coils of opposite polarity.

Applicants respectfully submit that a plurality of pieces of magnetic shimming material in Byrne do not constitute a coil at all. Further, these pieces of magnetic shimming material are not disposed axially further from the imaging volume than the main coil and are not configured to shield the main coil. Thus, the plurality of pieces of magnetic shimming material in Byrne simply fail to qualify as bucking coils. Moreover, Applicants respectfully submit that the Examiner has failed to establish that the iron rings in Byrne are even analogous to shaping coils for shielding interactions between coils of opposite polarity. That is, with regards to the rejections formulated by the Examiner, it would appear that the Examiner would sometimes attribute the role of shielding to the rings, and at others the role of shaping. Applicants submit that the rings cannot at once read on both of these elements of claim 17. Additionally, in none of the embodiments of Byrne are the ferromagnetic rings positioned between the main coil and the bucking coil as suggested by the Examiner. The iron rings disclosed in Byrne are associated with the main coils to cancel higher order terms in the magnetic field to achieve a very high degree of magnetic flux homogeneity in the imaging volume, rather than to shield interactions between coils of opposite polarity.

Furthermore, Byrne clearly intends the rings and coils to be used in the alternative. As is clear from the text itself and from the figures reproduced above, the coils 1(e), 1(f), 2(e) and 2(f) shown in the embodiment of Fig. 1 are not used in conjunction with the iron rings shown in Fig. 2. The combination suggested by the Examiner for using these elements together to read on the separate elements recited in claim 17 is simply not supported by the reference.

At least because Byrne do not teach, disclose or suggest (a) a bucking coil, (2) a shaping coil and (3) a plurality of ferromagnetic rings as claimed, the reference cannot support a *prima facie* case of anticipation of claim 17. Claims 18-19 depend directly or indirectly from claim 17. Accordingly, the Applicants submit that claims 18-19 are allowable by virtue of their dependency from an allowable base claim. Applicants also submit that the dependent claims are further allowable by virtue of the subject matter they separately recite. Thus, it is respectfully requested that the rejection of claims 17-19 under 35 U.S.C. §102(b) be withdrawn.

Rejections Under 35 U.S.C. § 103

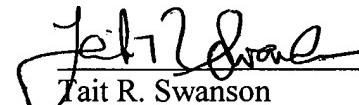
Claim 13 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Byrne in view of Chari et al., U.S. Patent No. 5,307,039 (hereinafter “Chari”). As discussed above, the Byrne reference does not teach, suggest or disclose each and every aspect of Applicants’ invention as recited in amended independent claim 1. Chari does not obviate the deficiencies discussed above. Insomuch as claim 13 depends directly from claim 1, and it is allowable by virtue of such dependency, as well as for the subject matter it separately recites. Thus, it is respectfully requested that the rejection of claim 13 under 35 U.S.C. §103(a) be withdrawn.

Conclusion

In view of the remarks and amendments set forth above, Applicants respectfully request allowance of the pending claims. If the Examiner believes that a telephonic interview will help speed this application toward issuance, the Examiner is invited to contact the undersigned at the telephone number listed below.

Respectfully submitted,

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